Atlantic Sturgeon Takes Under Closure Alternatives

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This analysis calculates the risk of sturgeon takes per unit effort and combines that with various alternative actions involving gillnet closure areas by different months.

Gear Removal and Redistribution

The Large Whale Take Reduction Team's NEFSC analyst, Laura Solinger, used the decision support tool (DST) to evaluate how gear would be moved or not fished under each scenario and relative to the baseline (gillnet gear effort distribution from 2017-2020).

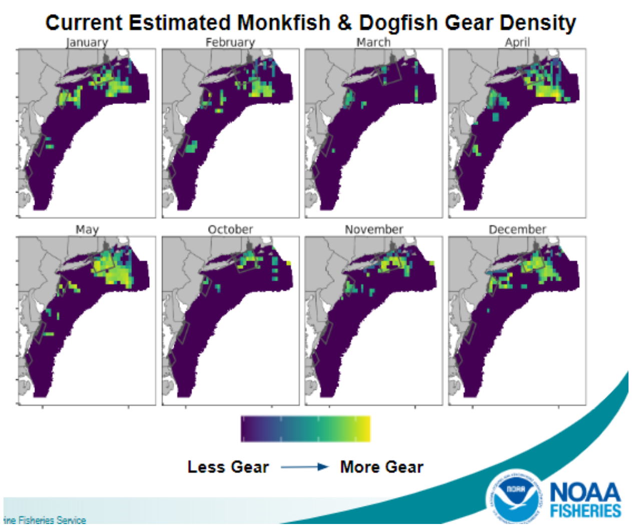

Figure 1: Example of current gillnet gear distribution relative to closure polygons.

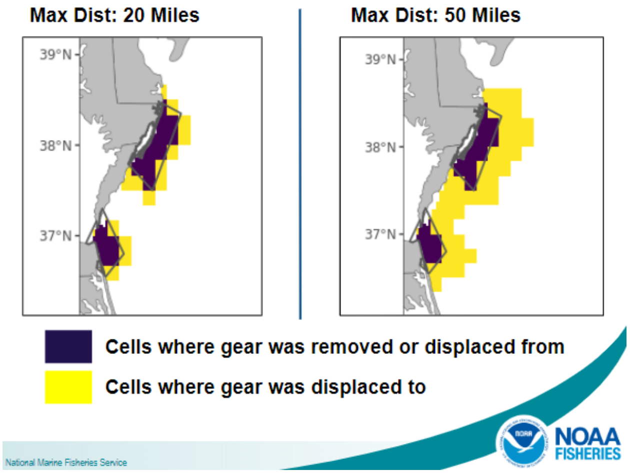

Figure 2: Example of gear redistribution based on maximum distance vessels will move in response to closures.

Create Risk Layer

The Northeast Fisheries Science Center (NEFSC) generated estimates of total annual discards of Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) from 2000 - 2022 in the otter trawl and gillnet fisheries. The analysis was conducted most recently by Boucher and Curti (2022) following the methods used by Miller and Shepherd (2011), Miller (2015), and Curti (2016). The general approach was to use observer data to estimate discards as a function of gear type, year, quarter of the year, and species landed. The resulting generalized linear model was then applied to data from all federal commerical gillnet trips.

I created a risk distribution layer for sturgeon by taking the NEFSC sturgeon gillnet take model and predicting it to all gillnet trips from 2012-2022 (2020 drops out due to lack of data in the NEFSC model). Data back to 2012 were used for the risk mapping because sturgeon takes are low probability events and more data was needed to create a smooth layer for when vessels move to areas with previously little fishing effort during 2017-2022. Without going back to 2012 for sturgeon risk the map becomes disjunct with gaps that were difficult to smooth. The trade-off with this approach is that sturgeon populations, movements, and gear selectivity can change over this time frame. However, the informal sensitivity analysis using only 2017 - 2022 data did not show large differences compared to the current analysis.

The expect sturgeon takes on each trip from the model results were then divided by the effort (days fished) on that trip. I removed the upper and lower 5% of effort trips from the risk mapping because effort can be misreported with fixed gear and this change in the denominator would have large effects on the rates (e.g. trip lands thousands of pounds of fish and discarded a sturgeon but the effort was only recorded as 5 minutes resulting in an expectation of 288 sturgeon takes per day at that location). Additionally, a minimum of 2 fishing hours was required for data inclusion in the risk mapping. The point-estimates from trips were then smoothed using inverse distance weighted interpolation by month to create smoother risk layers with gaps filled in. A distance-decay coefficient of 1.8 was used to weight closer trips more and balance local vs regional smoothing effects.

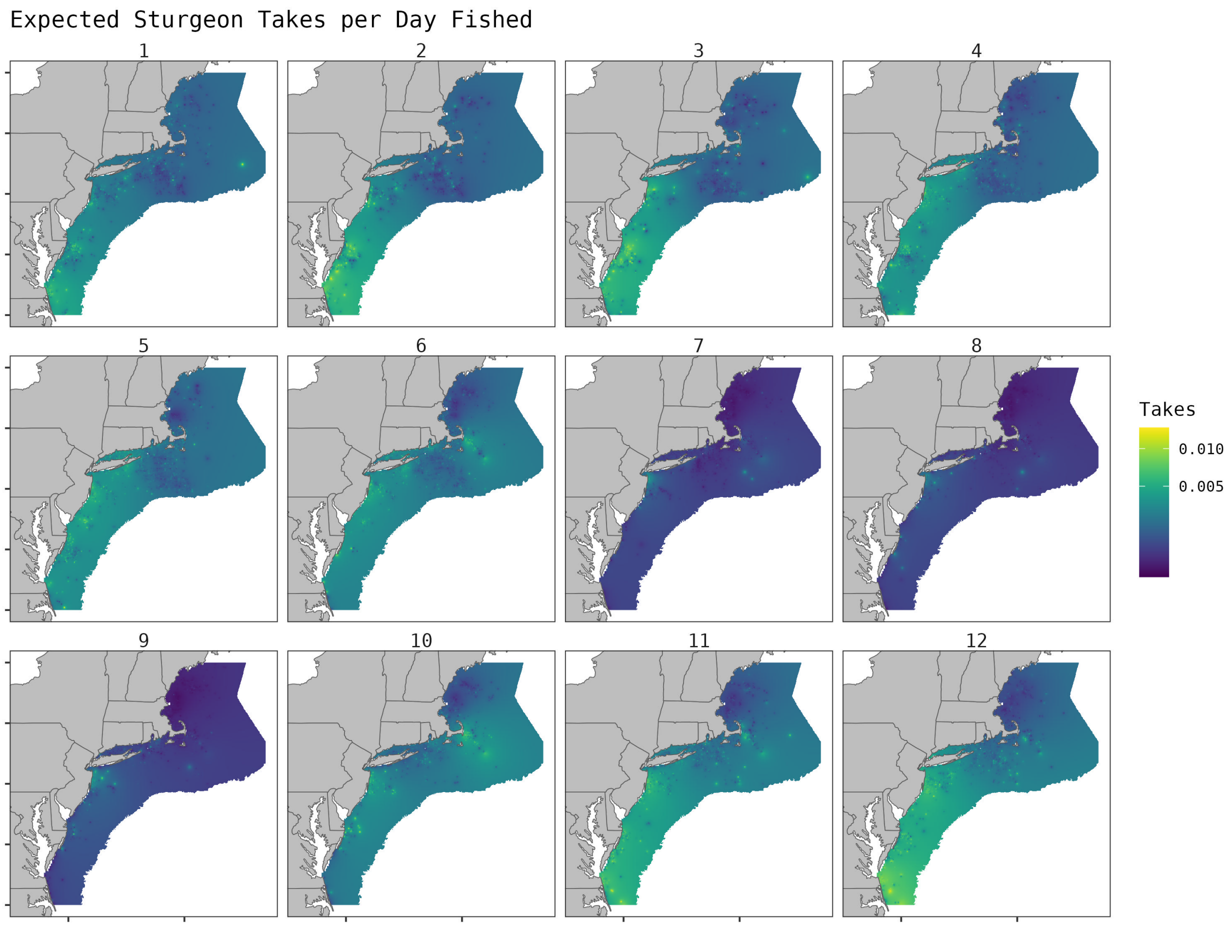

Figure 3: Expected Atlantic sturgeon takes per unit effort (days fished) by month.

Risk x Gear Density

I overlayed the resulting montly risk maps on the various monthly scenario maps and multiplied the risk per unit effort by the total effort in each raster square to get an index of the total estimated takes in each square under each gear movement/removal scenario. I finally calculated the percent total reduction in sturgeon takes expected under each scenario.

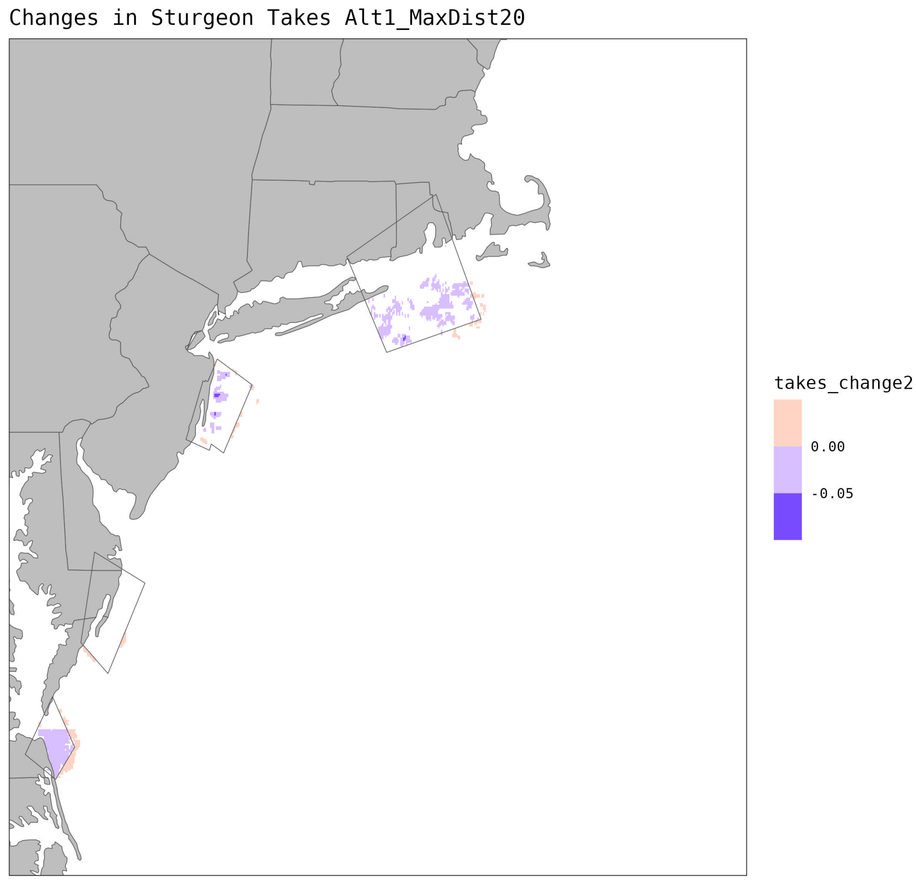

Figure 4: Example of change in sturgeon takes under alternative action 2 in December assuming a maximum distance of 20 nautical miles vessels will move from current fishing areas. In this scenario, most of the gear is removed from fishing due to lack of suitable fishing locations within the maximum distance allowed. Little gear is redistributed.

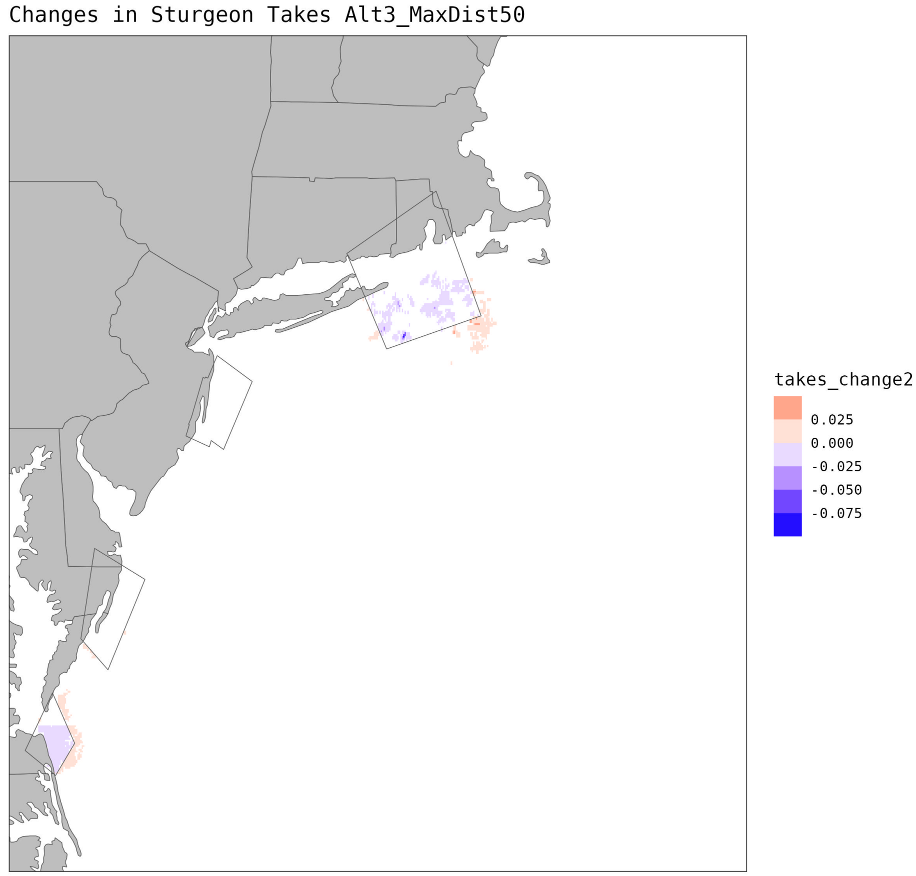

Figure 5: Example of change in sturgeon takes under alternative action 4 in December assuming a maximum distance of 50 nautical miles vessels will move from current fishing areas. In this scenario, most of the gear redistributes to other areas and little is removed. The results is only a slight decrease in expected sturgeon takes.

Table 1: Expected percent reduction of Atlantic Sturgeon takes by federally-permitted vessels using gillnet gears under various actions and behavior (max movement distance) scenarios. Action 1 is 'no action' and other alternatives not involving closures are also not listed.

Action	Max Distance Move (nm)	Percent Reduction
2	20	13.00%
2	50	4.20%
3	20	10.60%
3	50	3.20%
4	20	4.10%
4	50	1.90%

References

Boucher, J.M. and Curti, K.L. 2022. Discard Estimates for Atlantic Sturgeon through 2021. White paper (unpublished).

Curti, K. 2016. Updated Summary of Discard Estimates for Atlantic Sturgeon (White paper). NOAA/NMFS, Woods Hole, MA: Population Dynamics Branch.

Miller, T. J., and Shepherd, G.R. 2011. Summary of discard estimates for Atlantic sturgeon (White paper). NOAA/NMFS, Woods Hole, MA: Population Dynamics Branch.

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